2-step function machines

Notes and guidance

In this small step, children move on to explore function machines with two steps.

As with 1-step machines, they start by looking at examples where the input is given and they need to find the output, using a mix of any of the four operations. Discuss why it is important that they follow the order of the functions; for example, the output of × 5 then + 3 will be different from + 3 then × 5

Children then move on to finding the input when the output is known by using the inverse of each function, recognising that they need to start with the second function when working backwards.

Children then look at problems where the input and output are given, but one of the two functions is missing. They may choose to do this problem working forwards or backwards.

Things to look out for

- Children may not follow the order of the functions, and it is important to explore the effect this can have.
- When finding the input, children may do the inverse of the first function first.

Key questions

- Which function should you apply first?
- What happens if you do not follow the functions in the correct order?
- What is the inverse of _____?
- When given the output, which function should you do first?
- What is the input if the output is _____?
- What is the missing function if the input is _____, the output is ____ and one of the functions is _____?
- Does it always matter what order you apply the functions?

Possible sentence stems

- First, I am going to _____, then I am going to _____
- If the input is _____, then the output is _____
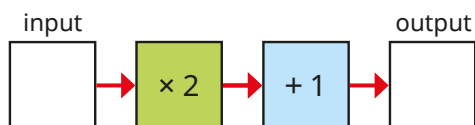- The inverse of _____ then _____ is _____ then _____

National Curriculum links

- Use simple formulae
- Find pairs of numbers that satisfy an equation with two unknowns
- Enumerate possibilities of combinations of two variables
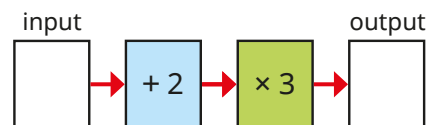
2-step function machines
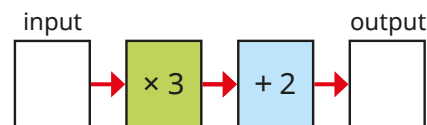
Key learning

- Here is a 2-step function machine.

input → ×2 → +1 → output

  ▸ If the input is 5, what is the output?

  ▸ If the input is 10, what is the output?

- Complete the tables for the function machines.

input → +2 → ×3 → output

Input	3	4	5	10
Output				

input → ×3 → +2 → output

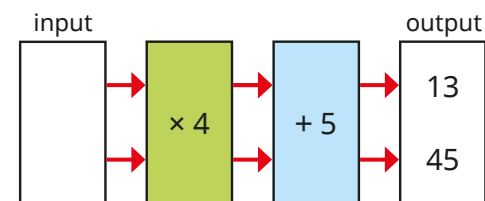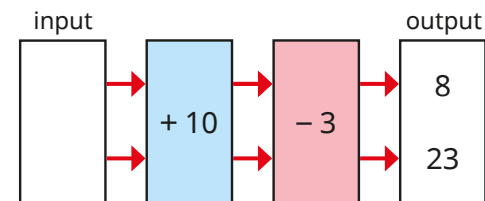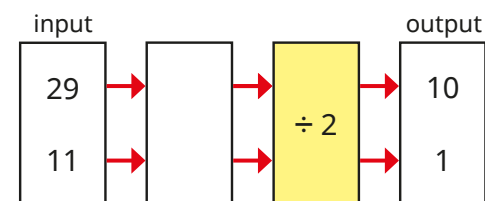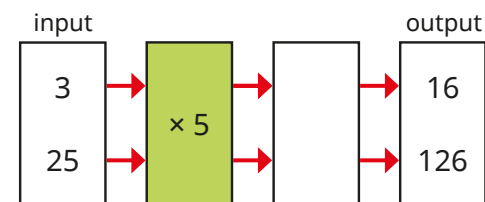| Input	3	4	5	10
Output				

What do you notice?

- I think of a number, double it, then add 4

  ▸ What answer will Max get if he thinks of 20?

  ▸ What number would Max need to think of to get the answer 20?
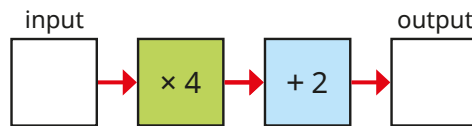
- Work out the missing inputs.

input → +10 → −3 → output 8
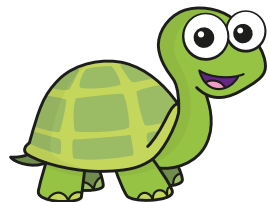input → +10 → −3 → output 23

input → ×4 → +5 → output 13
input → ×4 → +5 → output 45

- What are the missing functions?

input 3 → ×5 → ▢ → output 16
input 25 → ×5 → ▢ → output 126

input 29 → ▢ → ÷2 → output 10
input 11 → ▢ → ÷2 → output 1

2-step function machines

Reasoning and problem solving

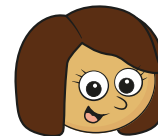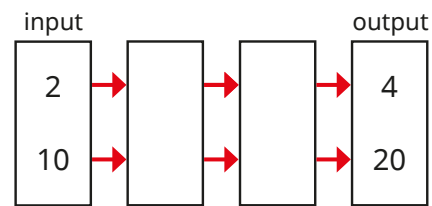Tiny is using a 2-step function machine.

input → ×4 → +2 → output

You can multiply numbers in any order, and you can add numbers in any order. This means you can solve this function machine in any order.

Do you agree with Tiny?

Explain your answer.

No

input 2, 10 → → → output 4, 20

Kim: The missing functions are × 4 and ÷ 2

Teddy: The missing functions are × 2 and × 1

Whitney: There only needs to be one function, which is × 2

Who do you agree with?

What other functions would work?

They are all correct.